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Look-ahead carry generator 74F182

FEATURES

- Provides carry look-ahead across a group of four ALUs
- Multi-level look-ahead for high speed arithmetic operation over long word lengths

DESCRIPTION

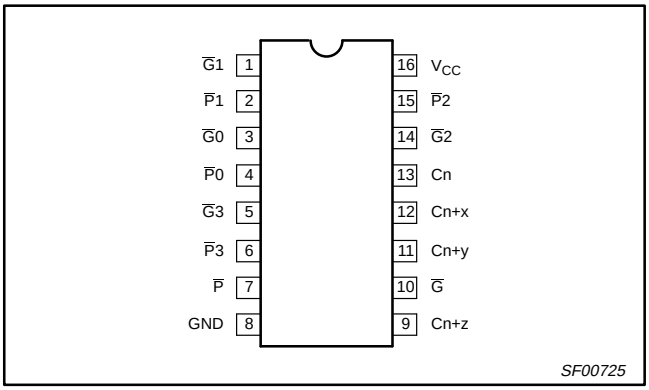
The 74F182 is a high speed carry look-ahead generator. It accepts up to four pairs of active-Low Carry Propagate ($\overline{P}0$, $\overline{P}1$, $\overline{P}2$, $\overline{P}3$) and Carry Generate ($\overline{G}0$, $\overline{G}1$, $\overline{G}2$, $\overline{G}3$) signals and an active-High Carry input (Cn) and provides anticipated active-High carries (Cn+x, Cn+y, Cn+z) across four groups of binary adders. The 74F182 also has active-Low Carry Propagate ($\overline{P}$) Carry Generate ($\overline{G}$) outputs which may be used for further levels of look-ahead.

The logic equations provided at the outputs are:

Cn+x = G0+P0Cn
Cn+y = G1+P1G0+P1P0Cn
Cn+z = G2+P2G1+P2P1G0+P2P1P0Cn
$\overline{G}$ = $\overline{G}3+\overline{P}3\overline{G}2+\overline{P}3\overline{P}2\overline{G}1+\overline{P}3\overline{P}2\overline{P}1\overline{G}0$
$\overline{P}$ = $\overline{P}3\overline{P}2\overline{P}1\overline{P}0$

The 74F182 can also be used with binary ALUs in an active-Low or active-High input operand mode. The connections to and from the ALU to the carry look-ahead generator are identical in both cases.

PIN CONFIGURATION



TYPE	TYPICAL PROPAGATION DELAY	TYPICAL SUPPLY CURRENT (TOTAL)
74F182	5.0ns	21mA

ORDERING INFORMATION

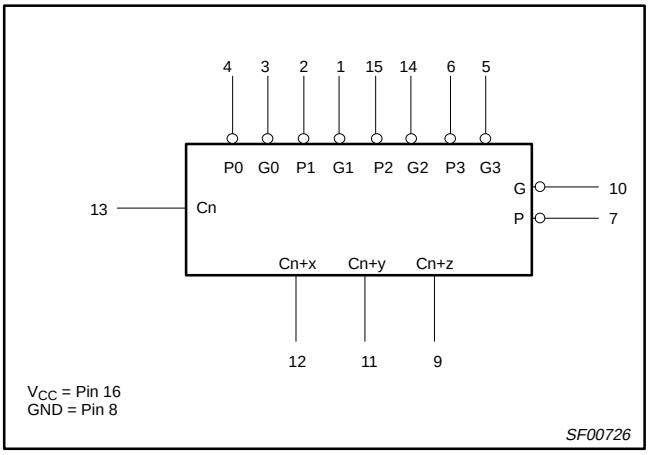
DESCRIPTION	ORDER CODE
	COMMERCIAL RANGE V_{CC} = 5V ±10%, T_{amb} = 0°C to +70°C
16-pin plastic DIP	N74F182N
16-pin plastic SO	N74F182D

INPUT AND OUTPUT LOADING AND FAN-OUT TABLE

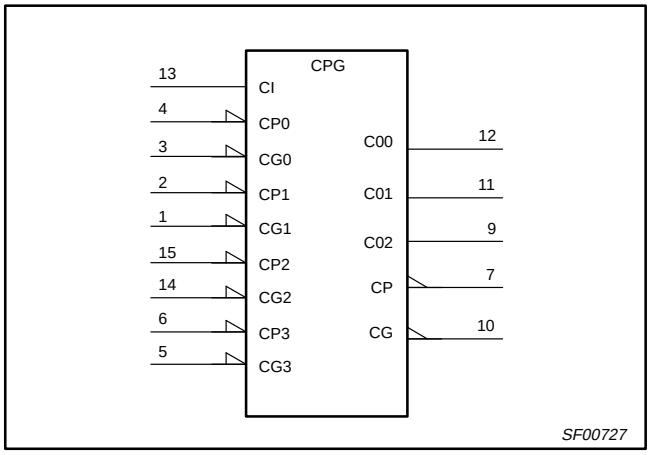
PINS	DESCRIPTION	74FAST (U.L.) HIGH/LOW	LOAD VALUE HIGH/LOW
Cn	Carry input	2.5/2.0	50µA/1.2mA
$\overline{G}0$, $\overline{G}2$	Carry generate inputs (active-Low)	2.5/14.0	50µA/8.4mA
$\overline{G}1$	Carry generate input (active-Low)	2.5/16.0	50µA/9.6mA
$\overline{G}3$	Carry generate input (active-Low)	2.5/8.0	50µA/4.8mA
$\overline{P}0$, $\overline{P}1$	Carry propagate inputs (active-Low)	2.5/8.0	50µA/4.8mA
$\overline{P}2$	Carry propagate input (active-Low)	2.5/6.0	50µA/3.6mA
$\overline{P}3$	Carry propagate input (active-Low)	2.5/4.0	50µA/2.4mA
Cn+x–Cn+z	Carry outputs	50/33	1.0mA/20mA
$\overline{G}$	Carry generate output (active-Low)	50/33	1.0mA/20mA
$\overline{P}$	Carry propagate output (active-Low)	50/33	1.0mA/20mA

NOTE:
One (1.0) FAST unit load is defined as: 20µA in the High state and 0.6mA in the Low state.

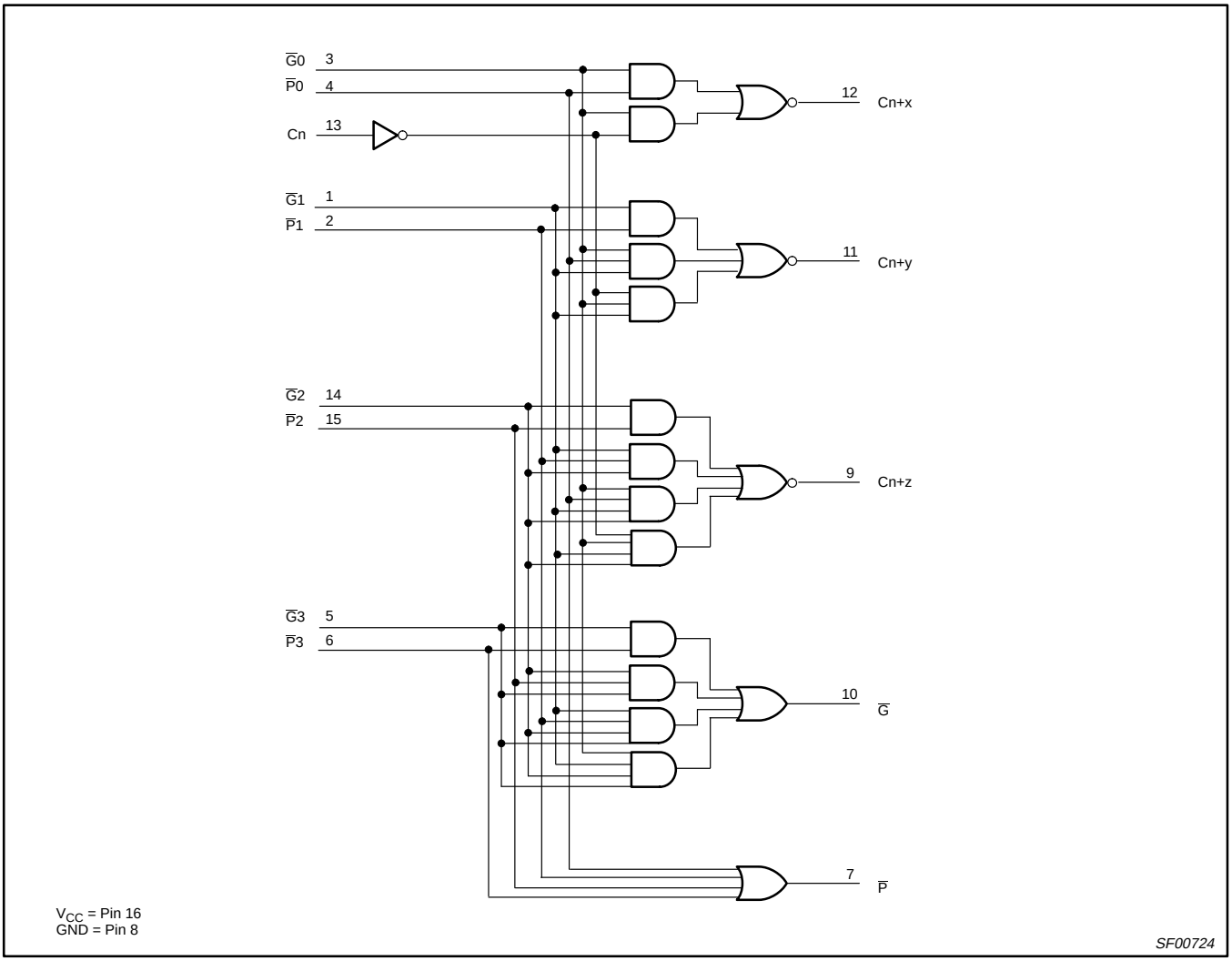
LOGIC SYMBOL



IEC/IEEE SYMBOL



LOGIC DIAGRAM



FUNCTION TABLE

INPUTS									OUTPUTS				
Cn	$\overline{G}0$	$\overline{P}0$	$\overline{G}1$	$\overline{P}1$	$\overline{G}2$	$\overline{P}2$	$\overline{G}3$	$\overline{P}3$	Cn+x	Cn+y	Cn+z	$\overline{G}$	$\overline{P}$
X	H	H							L				
L	H	X							L				
X	L	X							H				
H	X	L							H				
X	X	X	H	H						L			
X	H	H	H	X						L			
L	H	X	H	X						L			
X	X	X	L	X						H			
X	L	X	X	L						H			
H	X	L	X	L						H			
X	X	X	X	X	H	H					L		
X	X	X	H	H	H	X					L		
X	H	H	H	X	H	X					L		
L	H	X	H	X	H	X					L		
X	X	X	X	X	L	X					H		
X	X	X	L	X	X	L					H		
X	L	X	X	L	X	L					H		
H	X	L	X	L	X	L					H		
	X		X	X	X	X	H	H				H	
	X		X	X	H	H	H	X				H	
	X		H	H	H	X	H	X				H	
	H		H	X	H	X	H	X				H	
	X		X	X	X	X	L	X				L	
	X		X	X	L	X	X	L				L	
	X		L	X	X	L	X	L				L	
	L		X	L	X	L	X	L				L	
		H		X		X		X					H
		X		H		X		X					H
		X		X		H		X					H
		X		X		X		H					H
		L		L		L		L					L

NOTES:
H = High voltage level
L = Low voltage level
X = Don't care

APPLICATION

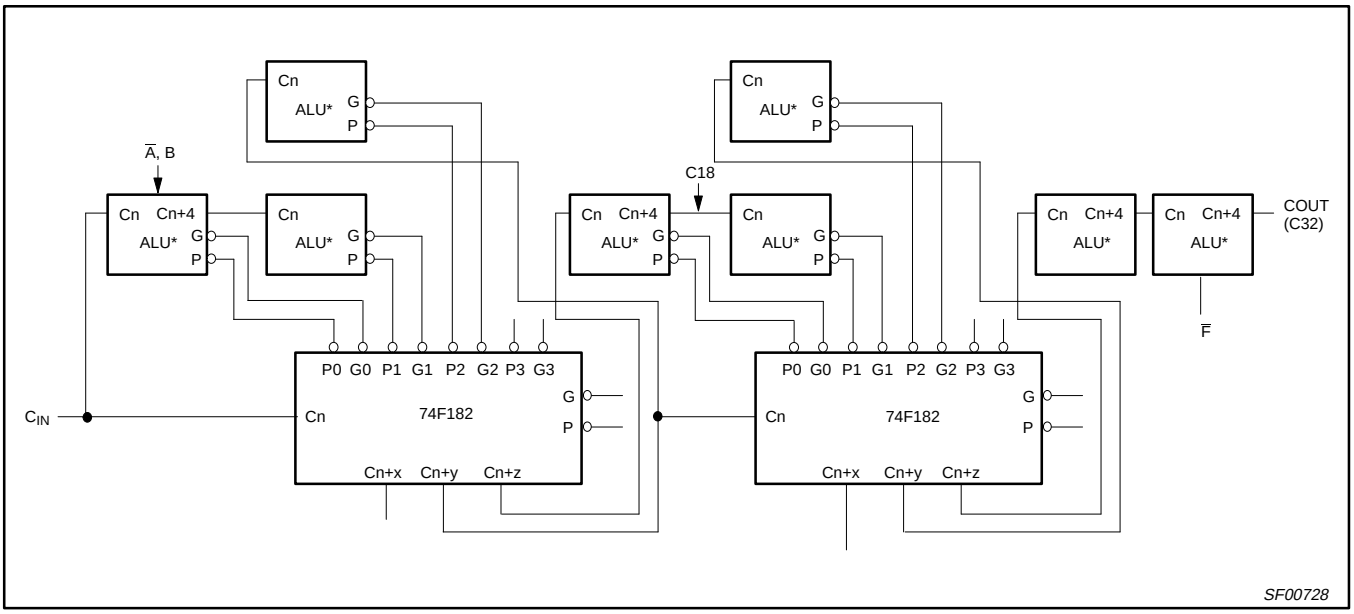


Figure 1. 32-Bit ALU with Ripple Carry Between 16-Bit Look-Ahead ALUs (*ALUs may be either 74F181 or 74F381)

ABSOLUTE MAXIMUM RATINGS

(Operation beyond the limit set forth in this table may impair the useful life of the device.
Unless otherwise noted these limits are over the operating free air temperature range.)

SYMBOL	PARAMETER	RATING	UNIT
V_{CC}	Supply voltage	–0.5 to +7.0	V
V_{IN}	Input voltage	–0.5 to +7.0	V
I_{IN}	Input current	–30 to +5	mA
V_{OUT}	Voltage applied to output in High output state	–0.5 to V_{CC}	V
I_{OUT}	Current applied to output in Low output state	40	mA
T_{amb}	Operating free-air temperature range	0 to +70	°C
T_{stg}	Storage temperature range	–65 to +150	°C

RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	LIMITS			UNIT
		MIN	NOM	MAX	
V_{CC}	Supply voltage	4.5	5.0	5.5	V
V_{IH}	High-level input voltage	2.0			V
V_{IL}	Low-level input voltage			0.8	V
I_{IK}	Input clamp current			–18	mA
I_{OH}	High-level output current			–1	mA
I_{OL}	Low-level output current			20	mA
T_{amb}	Operating free-air temperature range	0		70	°C

DC ELECTRICAL CHARACTERISTICS

(Over recommended operating free-air temperature range unless otherwise noted.)

SYMBOL	PARAMETER		TEST CONDITIONS[1]			LIMITS			UNIT
						MIN	TYP[2]	MAX	
V_{OH}	High-level output voltage		V_{CC} = MIN, V_{IL} = MAX, V_{IH} = MIN	I_{OH} = MAX	±10%V_{CC}	2.5			V
					±5%V_{CC}	2.7	3.4		V
V_{OL}	Low-level output voltage		V_{CC} = MIN, V_{IL} = MAX, V_{IH} = MIN	I_{OL} = MAX	±10%V_{CC}		0.30	0.50	V
					±5%V_{CC}		0.30	0.50	V
V_{IK}	Input clamp voltage		V_{CC} = MIN, I_I = I_{IK}				–0.73	–1.2	V
I_I	Input current at maximum input voltage		V_{CC} = MAX, V_I = 7.0V					250	µA
I_{IH}	High-level input current		V_{CC} = MAX, V_I = 2.7V					250	µA
I_{IL}	Low-level input current	Cn	V_{CC} = MAX, V_I = 0.5V					–1.2	mA
		$\overline{G}0$, $\overline{G}2$						–8.4	mA
		$\overline{G}1$						–9.6	mA
		$\overline{G}3$, $\overline{P}0$, $\overline{P}1$						–4.8	mA
		$\overline{P}2$						–3.6	mA
		$\overline{P}3$						–2.4	mA
I_{OS}	Short-circuit output current[3]		V_{CC} = MAX			–60		–150	mA
I_{CC}	Supply current (total)	I_{CCH}	V_{CC} = MAX				18	28	mA
		I_{CCL}					24	36	mA

NOTES:

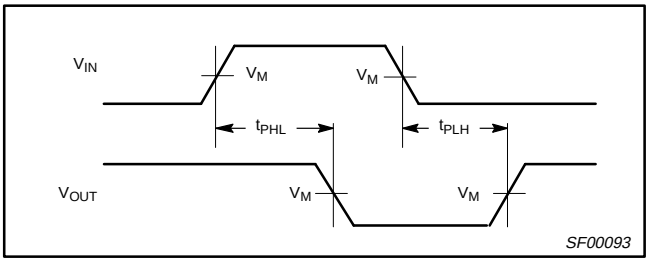
1. For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions for the applicable type.
2. All typical values are at V_{CC} = 5V, T_{amb} = 25°C.
3. Not more than one output should be shorted at a time. For testing I_{OS}, the use of high-speed test apparatus and/or sample-and-hold techniques are preferable in order to minimize internal heating and more accurately reflect operational values. Otherwise, prolonged shorting of a High output may raise the chip temperature well above normal and thereby cause invalid readings in other parameter tests. In any sequence of parameter tests, I_{OS} tests should be performed last.

AC ELECTRICAL CHARACTERISTICS

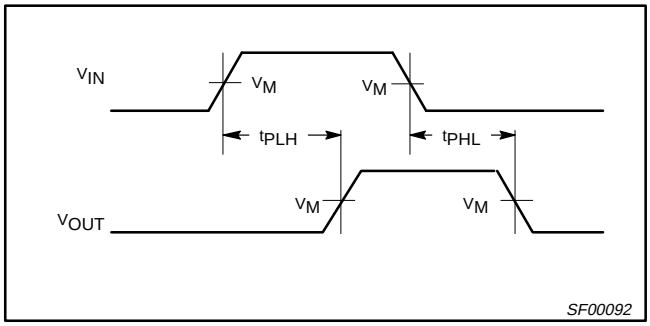
SYMBOL	PARAMETER	TEST CONDITION	LIMITS					UNIT
			V_{CC} = +5.0V T_{amb} = +25°C C_L = 50pF R_L = 500Ω			V_{CC} = +5.0V ± 10% T_{amb} = 0°C to +70°C C_L = 50pF R_L = 500Ω		
			MIN	TYP	MAX	MIN	MAX	
t_{PLH} t_{PHL}	Propagation delay Cn to Cn+x, Cn+y, Cn+z	Waveform 2	2.5 2.5	5.0 5.0	8.0 7.5	2.5 2.5	8.5 8.5	ns
t_{PLH} t_{PHL}	Propagation delay $\overline{P}0$, $\overline{P}1$, or $\overline{P}2$ to Cn+x, Cn+y, Cn+z	Waveform 1	2.0 1.5	5.0 3.5	7.0 5.0	1.5 1.5	8.0 6.0	ns
t_{PLH} t_{PHL}	Propagation delay $\overline{G}0$, $\overline{G}1$, or $\overline{G}2$ to Cn+x, Cn+y, Cn+z	Waveform 1	1.5 1.5	4.0 3.0	7.5 5.0	1.5 1.5	8.5 5.5	ns
t_{PLH} t_{PHL}	Propagation delay $\overline{P}1$, $\overline{P}2$, or $\overline{P}3$ to $\overline{G}$	Waveform 2	2.0 3.0	7.0 5.0	10.0 7.0	1.5 2.5	11.0 8.0	ns
t_{PLH} t_{PHL}	Propagation delay $\overline{G}n$ to $\overline{G}$	Waveform 2	1.5 3.0	5.0 5.0	7.0 7.0	1.5 2.5	7.5 8.0	ns
t_{PLH} t_{PHL}	Propagation delay $\overline{P}n$ to $\overline{P}$	Waveform 2	1.5 2.5	3.5 4.0	6.0 6.0	1.5 2.5	7.5 6.5	ns

AC WAVEFORMS

For all waveforms, V_M = 1.5V

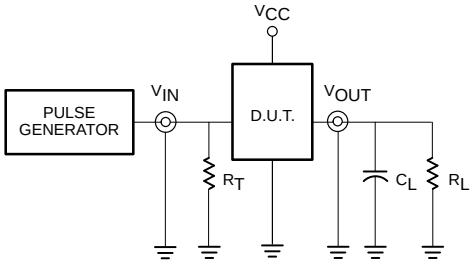


Waveform 1. Propagation Delay for Inverting Outputs

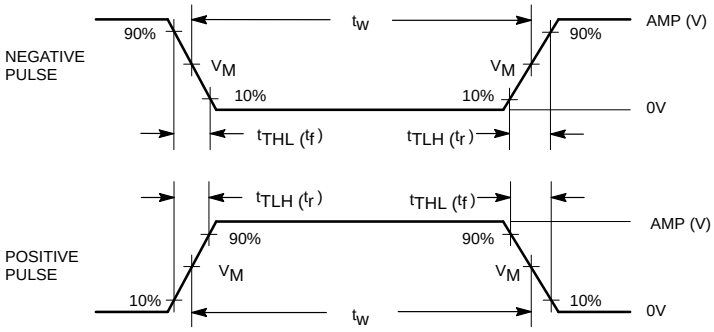


Waveform 2. Propagation Delay for Non-Inverting Outputs

TEST CIRCUIT AND WAVEFORMS



Test Circuit for Totem-Pole Outputs



DEFINITIONS:

R_L = Load resistor; see AC ELECTRICAL CHARACTERISTICS for value.

C_L = Load capacitance includes jig and probe capacitance; see AC ELECTRICAL CHARACTERISTICS for value.

R_T = Termination resistance should be equal to Z_{OUT} of pulse generators.

Input Pulse Definition

family	INPUT PULSE REQUIREMENTS					
	amplitude	V_M	rep. rate	t_w	t_{TLH}	t_{THL}
74F	3.0V	1.5V	1MHz	500ns	2.5ns	2.5ns

SF00006